Human Error and Risk Management

NASA Risk Management Conference (RMC VI)

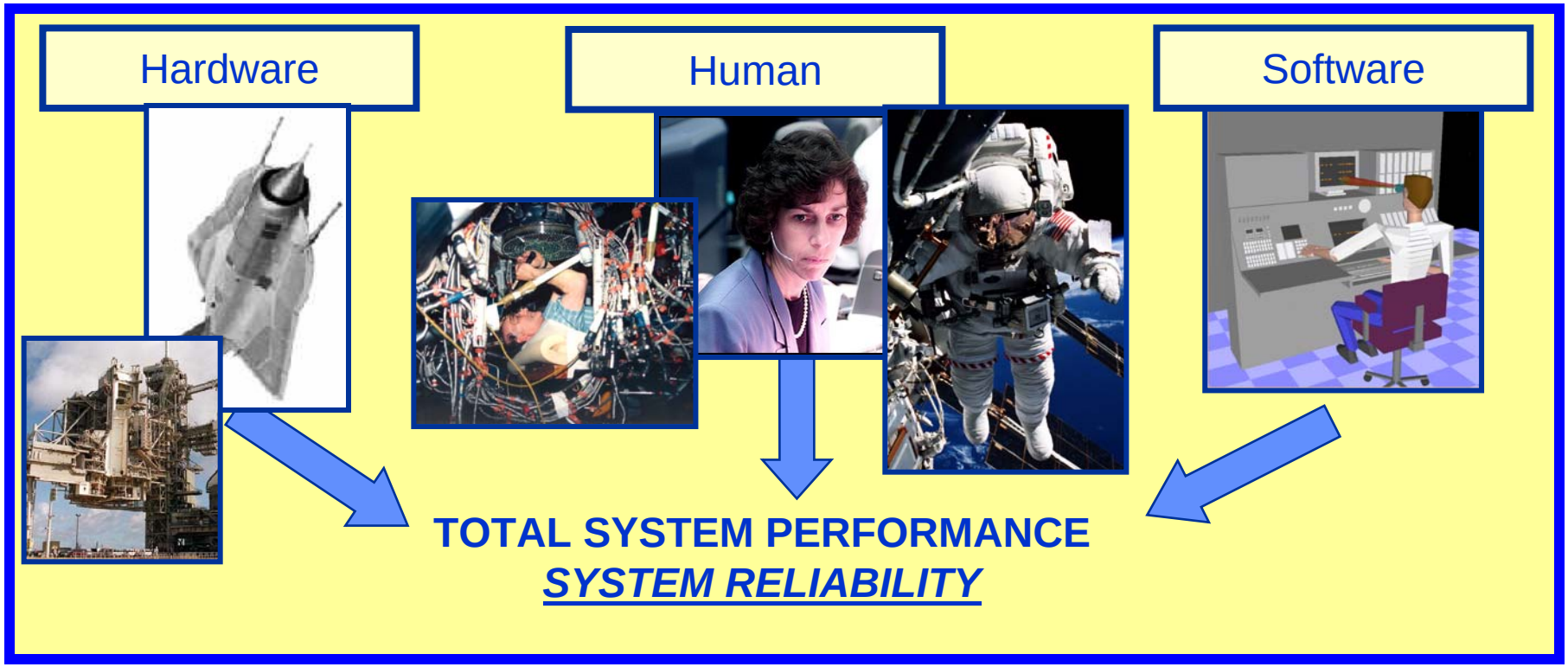
December 7, 2005

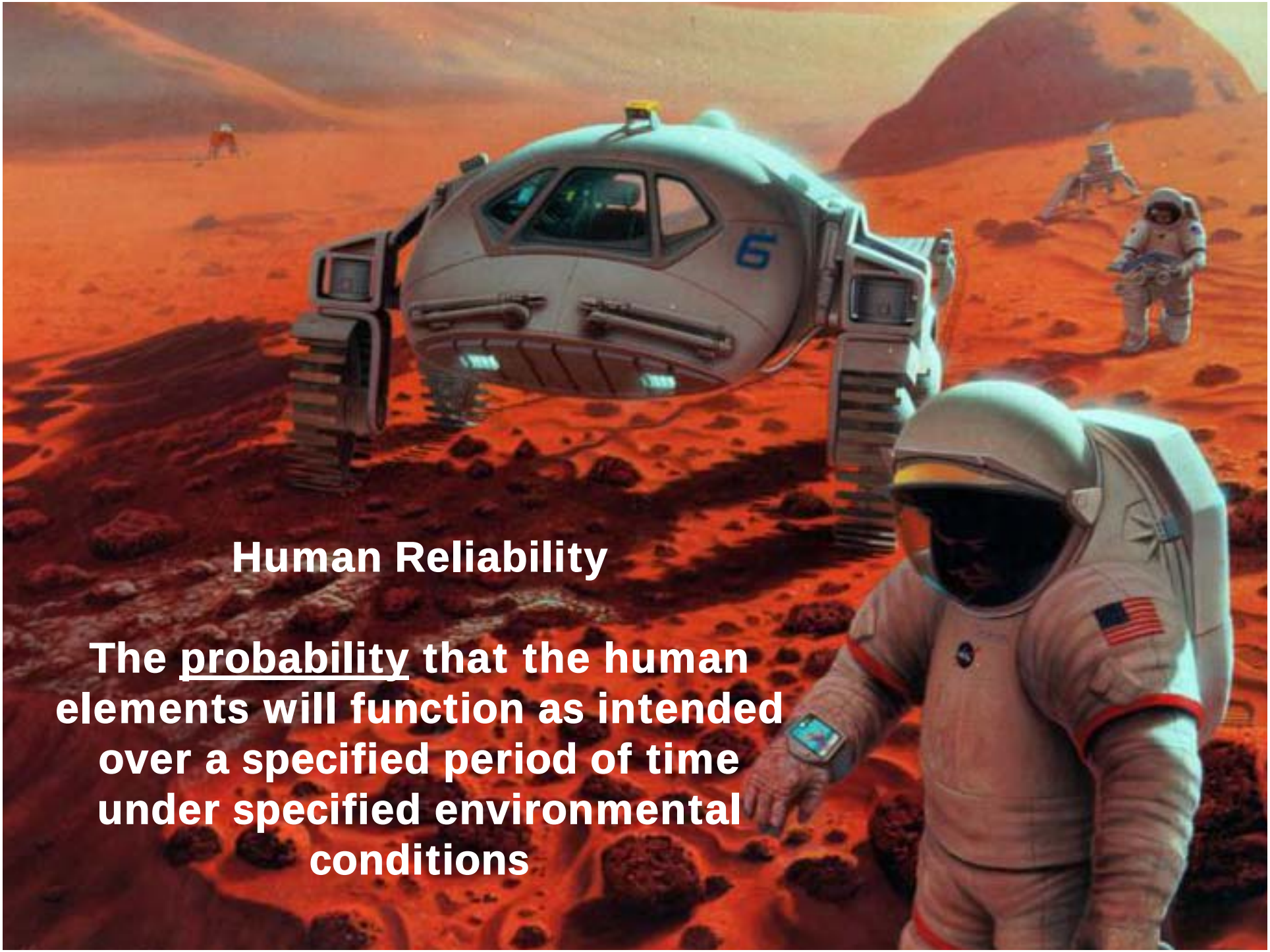
Faith Chandler
Human Reliability Program Manager
Office of Safety and Mission Assurance

System Reliability

To travel to the moon, establish a moon base and prepare for future mars missions NASA must produce reliable systems.

Total system reliability is more than just hardware and software performance. It includes human performance in space and on the ground.



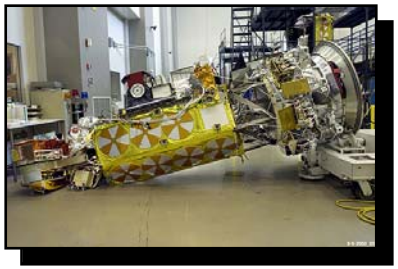

Human Reliability
The probability that the human elements will function as intended over a specified period of time under specified environmental conditions

Why is Human Reliability Important?

Human errors are a significant contributor to system failures, and they have measurable safety and monetary consequences.

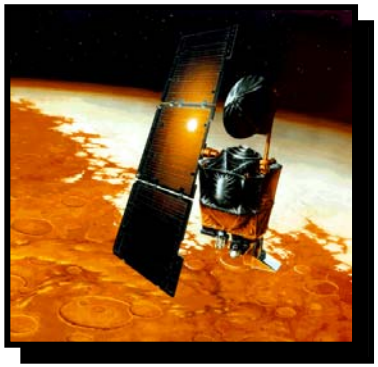
Human Errors contribute to loss of:

- **Human life;**
- **One-of-a-kind hardware;**
- **Government equipment & facilities;**
- **Scientific knowledge; and**
- **Public confidence**



NOAA N Prime
2003

Genesis
2004

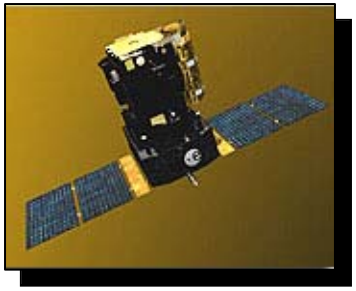


Mars Climate Orbiter

1999

Hessi
2000

Pad B Crane
2005



SOHO
1998

Human Error Causes Mishaps

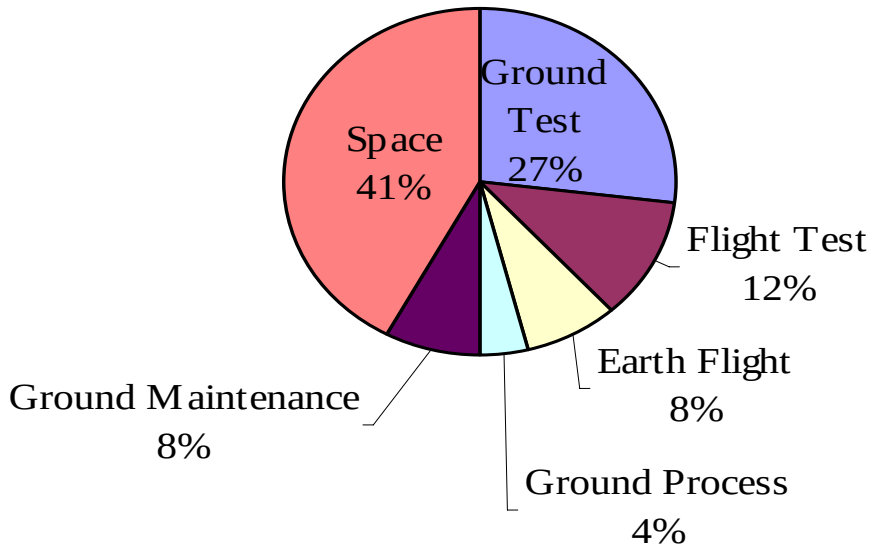
NASA

57% of Type A mishaps caused by human error (1996-2005)

*Does not include auto accidents or death by natural causes

78% of the Shuttle ground-support operations incidents resulted from human error (Perry, 1993).

Percentage of Type A Mishaps Occurring During Each Type of Activity 1996-2005



Outside NASA

75% of all US military aircraft losses involve sensory or cognitive errors (Air Force Safety Center, 2003).

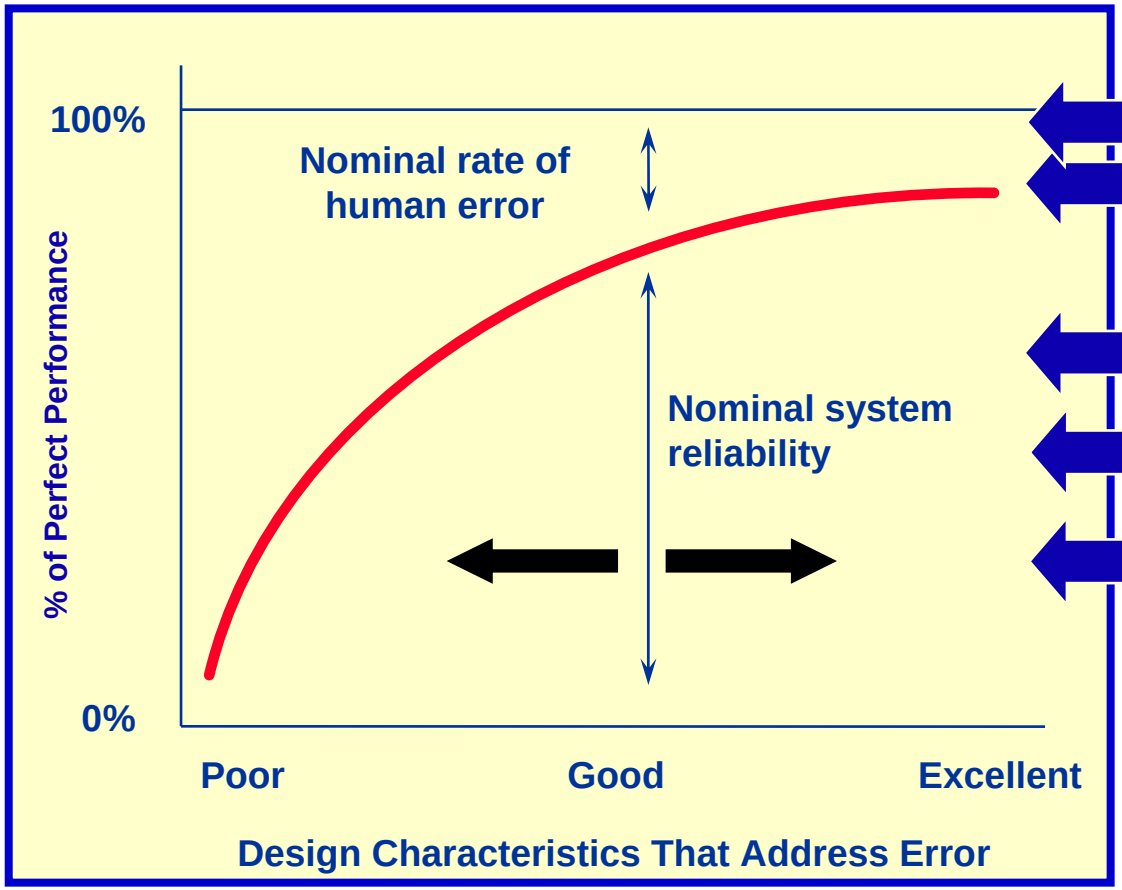
63% of approach & landing accidents involve inadequate monitoring and cross-checking (Air Force Safety Center, 2003).

83 % of 23,338 accidents involving boilers and pressure vessels were a direct result of human oversight or lack of knowledge (National Board of Boiler and Pressure Vessel Inspectors, 2005).

41% of mishaps at petrochemical plants were caused by human error (R.E. Butikofer, 1986).

Managing Human Reliability

Build "Error-Tolerant Systems" - systems that reduce the potential for errors and manage the effects of the errors that do occur



Mitigation limits the negative effects of error

System provides feedback to detect errors and controls to correct errors

System includes redundancy

System design reduces the potential for error/rate of error

System design prevents errors (incorporates barriers)

Order of Precedence

Sample of Human Reliability Activities

Human Reliability Assessment

- Human Reliability Methodology Study
- Human Reliability Database Development
- HF Process Failure Modes and Effects Analysis (HF PFMEA) Training and Software

Human Reliability in Design: Building Error Tolerant Systems

- Human Modeling Simulation – Launch Control
- Human Rating & Human System Integration Requirements
- MIDAS Tool Development (CAD Tool)

For More Information

Human Reliability Web Site

http://humanreliability-pbma-kms.intranets.com/login.asp?loc=&link=

Faith Chandler
202-358-0411
Faith.T.Chandler@NASA.gov

Man-Machine Design Analysis System (MIDAS)
Components of a Human Performance Model